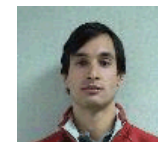
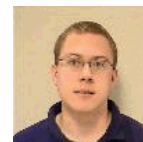


Accelerating Multidisciplinary Design Optimization with Machine Learning

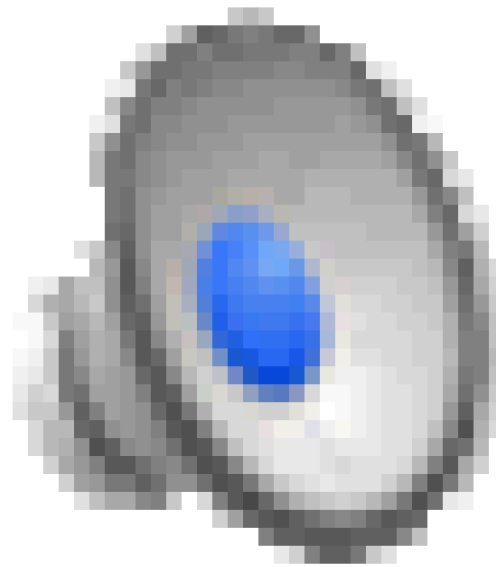
Sandia MLDL Conference: August 8th, 2017

Funding Sources: DOE, DARPA

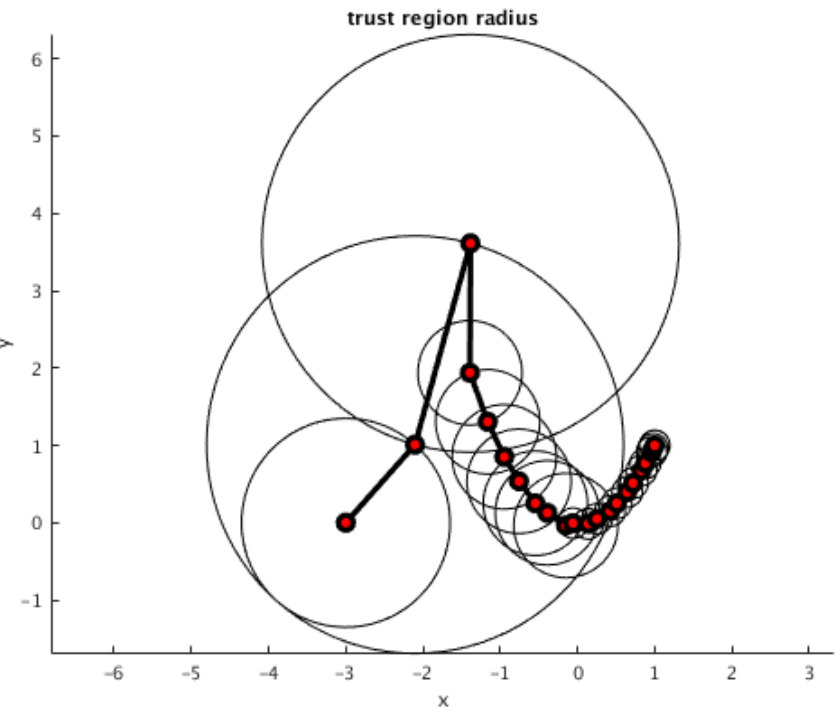
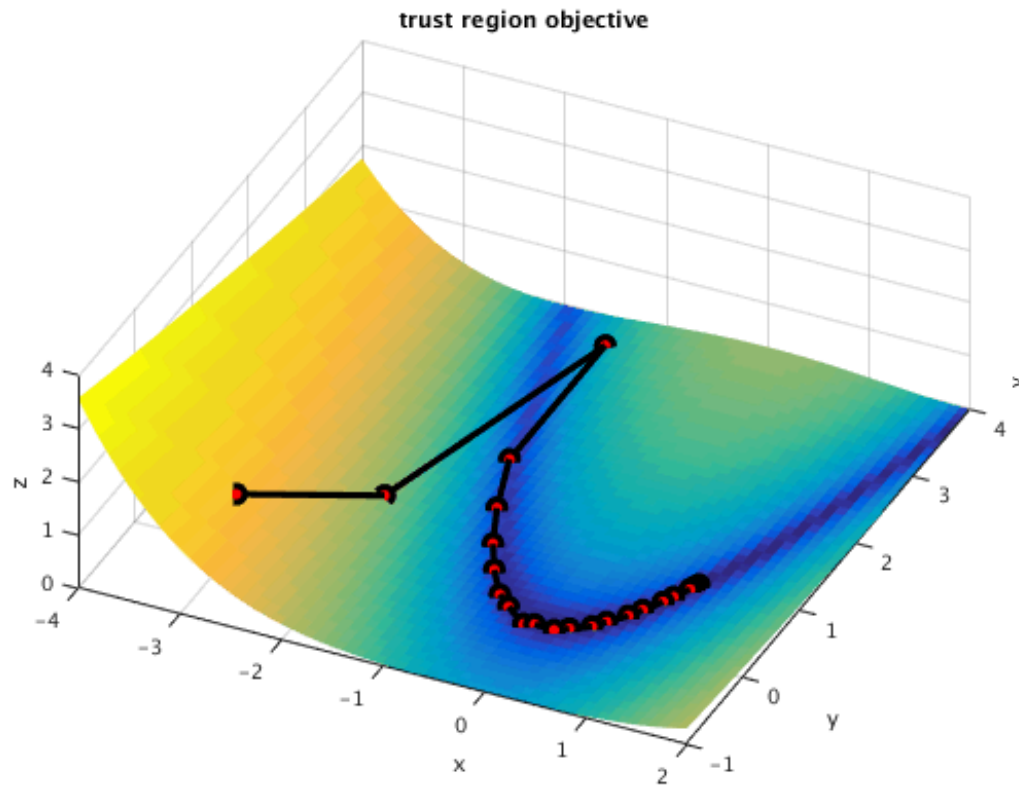
Contributors: Brett Sneed\1543, Miguel Aguilo\1543



What is Design Optimization?



What is a Trust Region Method?



Supervised Learning Problem

Problem: $f(\cdot)$ is expensive.

Basic Trust Region Algorithm:

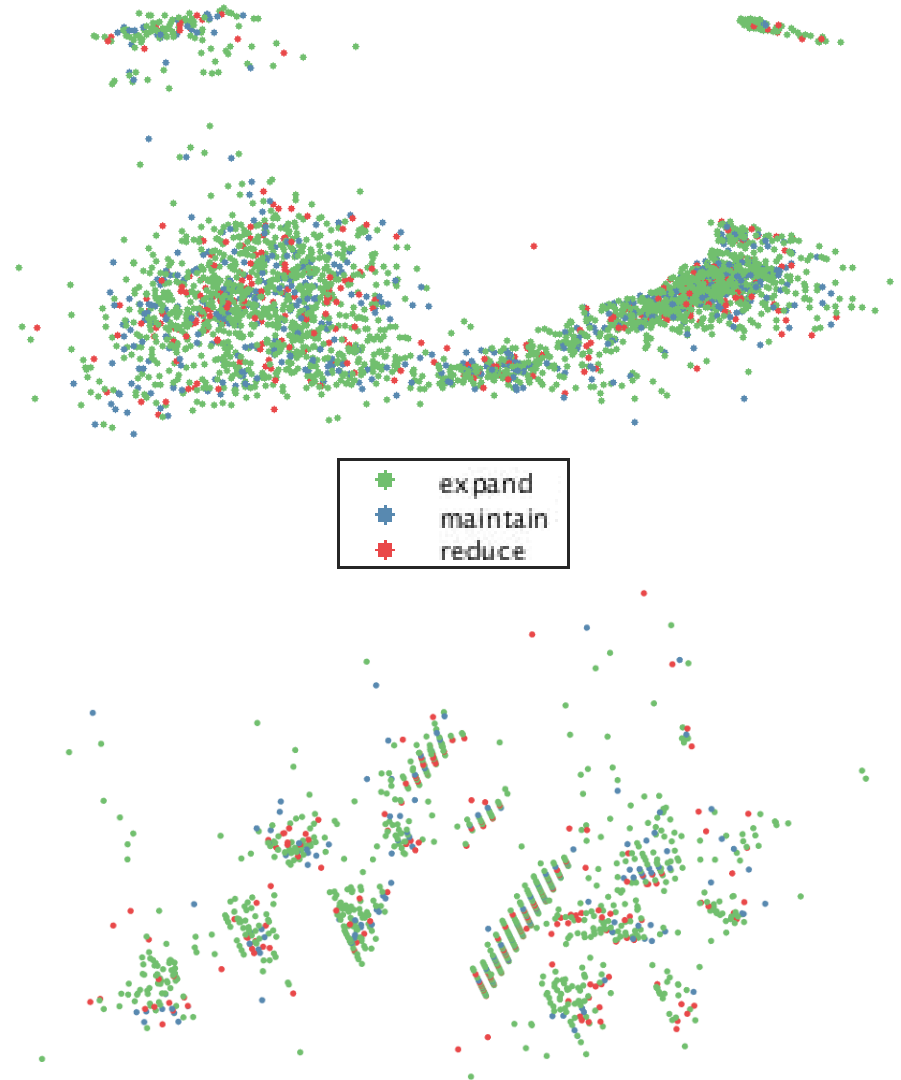
Every iteration compute

$$\rho_k = \frac{f(x_k) - f(x_k + s_k)}{f(x_k) - m_k(s_k)}$$

If $\rho_k \geq 0.75$, expand radius.

Else if $\rho_k \geq 0.25$, maintain radius.

Else, reduce radius.



Results

Simplified example problem:

$$f(x) = \sum_{i=1}^{N-1} S_i \left((x_{i+1} - k) - (x_i - k)^2 \right)^2 + (x_i - k - 1)^2$$

Speedup with machine learning: **x1.43**

Classifier	Accuracy	Recall of minority class
Neural Network	91.9%	74.5%
Naïve Bayes	69.1%	64.3%
ZeroR	71.0%	0%

Conclusion

Demonstrated feasibility of proposed idea.

Future Work

Accelerate a design problem with machine learning in PLATO, our massively parallel C++ design optimization code.

